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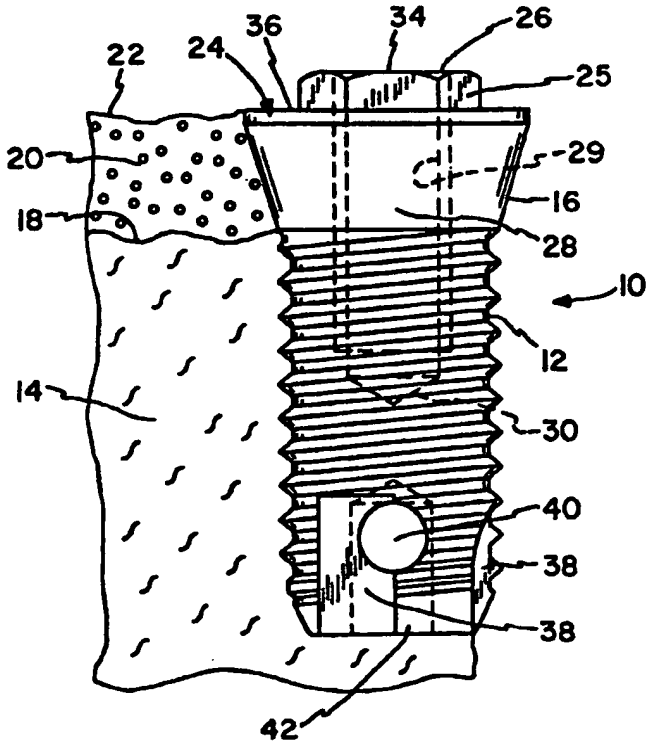
(54) Title: ONE-PIECE SINGLE-STAGE DENTAL IMPLANT AND SINGLE-STAGE DENTAL IMPLANT SYSTEM

(57) Abstract

A single-stage dental implant (10) for installation in living jawbone (14) having a ridge (18) that is covered by gingival tissue (20) is set forth. The dental implant (10) provides an artificial root on which a dental prosthesis is mounted to replace a missing tooth which formerly emerged from the jawbone. The single-stage implant comprises an anchoring portion (12) for extending into and integrating with the jawbone and an integral gingival section (16) that extends beyond the ridge of the jawbone. A seating surface (36) is located within the gingival section (16) and above the gingival tissue so as to be exposed after the implant is installed in the jawbone. The seating surface engages the dental prosthesis as the dental prosthesis is held thereon by a screw (160). The gingival section is contoured to replicate the natural emergence profile of the missing natural tooth. The prosthesis may extend axially from the implant or at an angle with the implant axis.



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ONE-PIECE SINGLE-STAGE DENTAL IMPLANT AND SINGLE-STAGE DENTAL IMPLANT SYSTEM

Field of the Invention

The invention relates generally to implants and, in particular, a single-stage dental implant that promotes healing of the gingiva and osseointegration simultaneously.

Background of the Invention

It is becoming more common to replace a missing tooth with a prosthetic tooth that is placed upon and attached to a dental implant. The dental implant serves as the artificial root in that it integrates with the jawbone. The prosthetic tooth preferably has a size and a color that mimics the missing natural tooth. Consequently, the patient has an aesthetically pleasing and structurally sound artificial tooth.

Current methods by which the prosthetic tooth and implant are completely integrated into the patient's mouth require six to ten months, and sometimes longer, because two distinct, time-consuming steps are involved. First, the implant is inserted into the jawbone and covered by suturing the overlying gingival tissue. Covering the implant with the overlying gingiva is needed to minimize the likelihood of infection around the implant. Covering the implant also helps to guard against any disturbances of the implant that may slow its rate of osseointegration. The implant then osseointegrates with the jawbone for a period usually in the range of three to six months.

After osseointegration is complete, the second step is encountered in which the gingiva is again cut open and a healing abutment is placed onto the implant. The overlying gingiva is sutured to allow it to properly heal around the healing abutment. Thus, when the prosthetic tooth is eventually placed upon the implant, the gingiva nicely conforms around the prosthetic tooth. However, it typically takes four to eight weeks before the gingiva is healed and the prosthetic tooth can be placed on the implant to complete the overall process.

Single-stage implants simultaneously promote osseointegration and the healing of the gingiva. This is accomplished by providing an implant that has a portion that integrates with the jawbone and a portion that extends through the overlying gingiva so that the gingiva properly heals therearound. Thus, the four to eight week gingival

healing process occurs during the three to six month period of osseointegration. Consequently, the patient is fitted with a prosthesis in a shorter period of time. And, the gingiva is lacerated and sutured one less time compared with two-stage systems which reduces the trauma to that region, the discomfort experienced by the patient, and the overall cost because the number of dental procedures is minimized.

Known single-stage systems utilize a two-piece configuration. One piece provides anchoring to the bone; the other piece provides the extension through the gingival tissue. These two components are held together usually by a screw configuration. However, these two components interface at a seam where bacteria can congregate and cause an infection. A seam also inhibits the ability of the implant to be cleaned after installation.

Furthermore, known single-stage systems do not provide for the proper emergence of the implant through the gingiva. This causes an unnatural appearance of the artificial tooth and, therefore, the final product is not aesthetically pleasing.

Summary of the Invention

The invention is a single-stage dental implant which is implantable in a living jawbone and when so implanted has a gingival end that extends above the jawbone and through the overlying gingiva. After the osseointegration of the implant into the jawbone and healing of the gingiva, a prosthetic tooth is installed on and supported by the implant. The invention also relates to the method in which the single-stage implant is installed into the jawbone.

The single-stage dental implant is typically installed through a ridge in the jawbone that is covered by gingival tissue. The dental implant provides an artificial root on which a prosthetic tooth is mounted to replace a missing tooth which formerly emerged from the jawbone. The single-stage implant comprises an anchoring portion for extending into and integrating with the jawbone and an integral gingival section that extends beyond the ridge of the jawbone. Because the gingival section is integral with the anchoring portion, there is no seam in which bacteria may collect to cause infections. A seating surface is located within the gingival section and above the gingival tissue so as to be exposed after the implant is installed in the jawbone. The seating surface

engages the prosthetic tooth and it is held thereon by fastening means. The gingival section is contoured to replicate the natural emergence profile of the missing natural tooth. Thus, the invention allows for a much more aesthetically pleasing dental prosthesis.

The prosthetic tooth generally includes an abutment and a core around which the material replicating the natural tooth is attached. The abutment and the core are typically fastened together with a screw. Often, the core is in the form of a conical gold cylinder which is commonly known in the art. The abutment generally interfaces with the prosthetic seating surface and includes a second seating surface mating with the core. Alternatively, the abutment may be fastened onto the implant and the core, which fits over the abutment, engages the prosthetic seating surface. The prosthetic tooth may extend in the same direction as the axis of the implant. Alternatively, it may extend in a direction forming an angle with the implant axis. As such, the single-stage implant is versatile in that it can be used to support a variety of prosthetic teeth which extend from the jawbone in various directions.

The above summary of the present invention is not intended to represent each embodiment, or every aspect, of the present invention. This is the purpose of the figures and the detailed description which follow.

Brief Description of the Drawings

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

FIG. 1 is a side elevation of an implant in a jawbone;

FIG. 2 is a top end view of the implant;

FIG. 3 is a bottom end view of the implant;

FIG. 4 is a partially-schematic exploded side view of an alternative implant in jawbone with a component that is attachable to it, with the component and the upper portion of the implant in section;

FIG. 5 is a section taken generally along line 5--5 in FIG. 4;

FIG. 6 is a side view, partially broken away, showing the implant and component of FIG. 4 assembled to support a conical abutment;

FIG. 7 is a section taken generally along line 7–7 in FIG. 6;

FIG. 8 is a side view of another component;

FIG. 9 is a side view of a conical angled abutment assembled on the alternative implant; and

FIG. 10 is a side view of another conical angled abutment assembled on the alternative implant.

While the invention is susceptible to various modifications and alternative forms, a specific embodiment thereof has been shown by way of example in the drawings and will herein be described in detail. It should be understood, however, that it is not intended to limit the invention to the particular forms disclosed the contrary. The intention is to cover all modifications, equivalents, and alternatives falling within the spirit and scope of the invention as defined by the appended claims.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

In FIG. 1, an implant 10 has a generally cylindrical main body portion 12 with external threads and is embedded in a jawbone 14. A gingival section 16 of the implant 10 extends above the apical surface 18 of the jawbone 14 and through the overlying gingiva 20. As shown in FIG. 1, the gingival section 16 is integral with the body portion 12 such that there is no seam between these two components in which bacteria may congregate. The implant 10 is exposed at an upper surface 22 of the gingiva 20 at a gingival end 24. A hexagonal boss 25 is disposed upon the gingival end 24. The boss 25 is received by a corresponding hexagonal socket of a mating prosthesis (including any abutments selected to facilitate the interface between the artificial tooth and the implant) and, therefore, prevents relative rotation between the implant 10 and the prosthesis. Although shown as hexagonal, the boss 25 can be any non-circular shape. An axial bore 28 extends from a top surface 26 of the boss 25 to an interior end 30 within the main body portion 12. The bore 28 includes internal threads 29 from an area near the interior end 30 to the top surface of the boss 25. The entry end 34 of the bore 28 is located at the center of the top surface 26 of the boss 25. A prosthetic seating surface 36 is formed on the gingival end 24 and is defined by the periphery of the gingival end 24 and the periphery of the boss 25, as can be seen in FIG. 2. The prosthetic seating surface 36 is the surface against which a corresponding surface of a mating prosthesis abuts.

The implant 10 can be formed in various lengths and widths depending upon the dimensions of the jawbone 14 in which it is implanted. Generally, the width of the gingival section 16 is approximately the same as the width of the natural tooth which the implant 10 is replacing. After an opening in the gingiva 20 has been cut to expose the jawbone 14, a recess in the jawbone 14 is typically prepared by drills of increasing dimension. The implant 10 is then fitted into the opening of the recess in the jawbone 14. The threads along the lower portion of the main body 12 are self-tapping threads 38 so that it is unnecessary to tap the recess in the jawbone 14. A tool that engages the hexagonal boss 25 is used to rotate the implant 10 and screw it into the jawbone 14.

To help integrate the implant 10 into the jawbone 14, the lower portion of the implant 10 has two cavities. A diametral cavity 40 extends through the implant 10 in the transverse direction. An axial cavity 42 extends into the bottom of the implant 10 and intersects the diametral cavity 40, as can be seen in FIG. 3. The tissue of the jawbone 14 grows into these cavities 40, 42 to integrate the implant 10 into the jawbone 14. Although only the diametral cavity 40 and the axial cavity 42 are shown in FIGS. 1-3, additional cavities can be formed along the main body portion 12 to further enhance the locking of the implant 10 to the jawbone 14.

The gingival section 16 tapers outwardly from its lower end to the gingival end 24. Preferably, the gingival section 16 expands to a size approximating the size of the natural tooth that was removed from the site where the implant 10 is fixed in the jawbone 14. The tapered gingival section 16 determines the size and shape of the opening in the gingiva 20 as the gingiva 20 heals around the implant 10. Also, the gingival section 16 has a smooth surface, as is seen in FIG. 1, allowing for hygienic maintenance of the implant 10 after installation. The tapered gingival section 16 also serves to limit the axial movement of the implant 10 into the jawbone 14 during installation and when the implant 10 is subjected to stresses after installation.

The tapered gingival section 16 provides for a more natural emergence profile of the prosthesis which is to be mounted on the implant 10. As shown in FIG. 2, the cross-section of the gingival section 16 is circular. However, if desired, the cross-section of the tapered gingival section 16 can be non-uniform to more closely replicate the emergence profile of the natural tooth which the prosthesis is replacing. The abutting surface of the

prosthesis (not shown) preferably has a periphery corresponding to the periphery of the prosthetic seating surface 36.

The gingival end 24 of the implant 10 extends through the upper surface 22 of the gingiva 20 so as to be easily accessed. After the healing of the gingiva 20 around the gingival section 16 and adequate osseointegration, a prosthesis is positioned against the prosthetic seating surface 36. The lower end of the prosthesis has a hexagonal socket which receives the hexagonal boss 25 of the implant 10. Because the boss 25 and the corresponding socket of the prosthesis are non-circular, the prosthesis cannot rotate relative to the implant 10. The prosthesis is secured to the implant 10 by a screw which extends through a through-bore in the prosthesis and mates with the internal threads 29 of the bore 28 of the implant 10. The exposed head of the screw within the prosthesis is then covered by common techniques for aesthetic purposes.

The single-stage dental implant 10 provides for simultaneous healing of the gingiva 20 and osseointegration after the installation of the implant 10 into the jawbone 14. The gingiva 20 is surgically cut to expose the jawbone 14 at the location where the implant 10 is to be placed. A recess is produced in the jawbone 14 by common drilling techniques which minimize the damage to the surrounding jawbone 14 structure. Often, the recess left after a natural tooth is removed can accommodate the implant 10 and no drilling is needed. The lower portion of the main body 12 of the implant 10 is positioned in the recess. A tool then engages the boss 25 of the implant 10 and is rotated to screw the implant 10 into the jawbone 14. The self-tapping threads 38 along the lower region of the main body portion 12 cut into the jawbone 14 as the tool rotates the implant 10. Once the implant 10 is positioned at the appropriate depth in the jawbone 14 with the gingival end 24 still above the upper surface 22 of the gingiva 20, the tool is disengaged from the implant 10. Thus, the upper surface 22 is positioned at least above the upper surface 22 of the gingiva 20. The gingiva 20 around the protruding gingival end 24 of the implant 10 is then repaired by common surgical techniques. The entry part 34 of the bore 28 is then covered by various common techniques so that no particles can enter the bore 28. A bridge is then affixed to adjacent teeth and covers the gingival end 24 of the implant 10. The bridge provides the implant 10 with protection from disturbances which normally occur as the patient chews. Thus, movement of the implant 10 is minimized

and osseointegration is promoted. The gingiva 20 heals generally within four to eight weeks. Complete osseointegration of the implant 10 in the jawbone 14 occurs within three to six months depending on the age of the patent and the condition of the jawbone 14 structure. After osseointegration, the bridge is removed and the mating prosthesis is attached to the implant 10.

In contrast, a two-stage implant system first promotes osseointegration by maintaining an implant submerged in a jawbone below the overlying gingiva for three to six months. Once the osseointegration has occurred, the overlying gingiva is then manipulated and an abutment or a temporary tooth is placed on the implant around which the gingiva heals for an additional four to eight weeks. Finally, the prosthesis is attached to the implant. Thus, a single-stage system utilizing implant 10 greatly reduces the overall time required to replace a problematic natural tooth with a prosthesis.

FIGS. 4-10 illustrate an alternative single-stage implant system including the mating abutments. In FIGS. 4 and 5, the implant 110 has a generally cylindrical main body portion 112 which is embedded in jawbone 114. A gingival section 116 extends above the apical surface 118 of the jawbone 114 and through the overlying gingiva 120. The main body portion 112 generally has external threads which include self-tapping threads near the lower end of the main body portion 112. As shown, a gingival end 124 of the implant 110 protrudes above the upper surface 122 of the gingiva 120. The gingival section 116 expands in cross-sectional size from the main body 112 to the gingival end 124, desirably to a size approximating the size of the natural tooth that was at the site where the implant 110 is fixed in the jawbone 114. An axially aligned bore 126 extends from the gingival end 124 to an interior end 128 within the main body portion 112. This bore 126 includes a threaded part 130 which extends from the interior end 128 toward the gingival end 124 which receives a screw from a mating abutment or prosthesis. A socket part 132 has a wider cross-section than the threaded part 130 and a non-circular (e.g., polygonal) shape to prevent rotation of a mating component. An entry part 134 has a still wider cross-section than the socket part 132 and expands preferably on a small conical angle toward its entrance at the gingival end 124. A tool having a portion which fits into the socket part 132 engages the socket part 132 during installation of the implant 110. A prosthetic seating surface 136 with an annular shape formed at the

top on the gingival section 116 surrounds the gingival end 124. A tapering side surface 138 extends between the prosthetic seating surface 136 and the endmost transverse surface of the implant 110 at the gingival end 124.

The component 140 is generally tubular in form with three axially-aligned sections. The first section 142, which is nearest to the implant 110 as shown in FIG. 4, has the same cross-sectional shape as, and is only slightly smaller in size than, the socket part 132 of the bore 126. The first section 142 interlocks with the socket part 132 so as to prevent relative rotation between the component 140 and the implant 110 when the two are assembled. The second, intermediate section 144 is larger in cross-sectional size than the first section 142 and has a slight external taper matching the internal taper of the entry part 134 of the bore 126. The third section 146 has a reversed taper which reduces the cross-sectional size of the component 140 toward its supragingival end 148. Internally, the component 140 has an axial bore 150 with a round entrance section 152 at its supragingival end 148. A smaller round section 154 is disposed below the entrance section 152 with a tapered shoulder 156 between them. An internally-threaded section 158 extends below round section 154 and engages a screw which enters bore 150 to attach component 140 to implant 110.

The implant 110 and the component 140 are shown in FIGS. 6 and 7 as assembled with an abutment screw 160 of known design. The abutment screw 160 has a threaded shaft 162 at one end configured for mating with the internally-threaded part 130 of the implant bore 126 shown in FIG. 4. A neck section 164 of the abutment screw 160 has a smaller cross-section than the threaded shaft 162. A sloped shoulder 165 resides between the lock-down section 166 and the neck section 164. A non-circular manipulating section 168 terminates at the upper end of the abutment screw 160. With the implant 110, component 140 and abutment screw 160 assembled as shown, the interlocking section 142 of the component 140 contacts the socket part 132 of the implant 110. And, the sloped shoulder 165 of the abutment screw 160 engages the tapered shoulder 156 in the component 140 such that tightening the abutment screw 160 forces the component 140 into the implant bore 126. The internally-threaded bore section 158 of the component 140 is useful to hold the abutment screw 160 captive with

the threaded shaft 162 so that the screw 160 can carry the component 140 to the implant 110 and position it for attachment to the implant 110.

Assembled as shown, the tapering third section 146 of the component 140 and manipulating section 168 of the abutment screw 160 form a conical abutment on which a conical gold cylinder or core 174 of known form can be mounted. The abutment screw 160 has also an internally-threaded bore 170 extending axially into the screw 160 at the upper end of the manipulating section 168 and into the lock-down section 166 for receiving a mounting screw 172. A known conical gold cylinder 174 is positioned over the conical abutment and the mounting screw 172 fastens the gold cylinder 174 in place. The gold cylinder 174 with a trumpet-like configuration has a flange 176 which meets the prosthetic seating surface 136 and its adjoining sloped surface 138 when the mounting screw 172 is tightened through a smaller opening 178 at the narrower end of the gold cylinder 174. The gold cylinder 174 makes contact with the conical abutment only between the flange 176 and the prosthetic seating surface 136 and the tapered side surface 138. Also, the underside of the head of the mounting screw 172 engages the bottom surface of the opening 178 of the gold cylinder 174. As is known, the gold cylinder 174 becomes wrought into an artificial tooth, or a prosthesis, which is the reason the abutting surface of the implant 110 is known as the prosthetic seating surface 136. The prosthesis is seated directly on the implant 110 making contact with both the prosthetic seating surface 136 and the adjacent sloping side surface 138.

A component 180 shown in FIG. 8 is similar to the component 140 in FIGS. 4-6, with the addition of a non-circular (e.g., polygonal) array of flat surfaces 182 in the tapered section 186 which corresponds to the tapered section 146 of component 140 in FIG. 4. The flat surfaces 182 enable the non-rotational attachment of the gold cylinder 174 to the conical abutment if the gold cylinder 174 is fitted internally with a mating socket. Thus, the tapered section 186 can have a hexagonal cross-section in the region of the flat surfaces 182, and the interior of the gold cylinder 174 can be fitted with a similar array of flat surfaces (not shown) for interlocking with the flat surfaces 182 of the component 180. The component 180 also has an implant interlocking portion 188 similar to the first section 142 of component 140. Therefore, the component 180 is interlocked against rotation on the implant 110 via the implant interlocking portion 188,

and the gold cylinder 174 is interlocked against rotation on the component 180 due to flat surfaces 182.

FIGS. 9 and 10 show embodiments of the invention suitable for mounting angled abutments on the implant 110. Each figure shows the implant 110 fixed on an axis A-A in a situation where it is desired to fix a prosthesis in the patients mouth on a different axis B-B. In FIG. 9, an angled abutment 190 has in a first part 191 positioned along axis A-A, a stem 192 of non-round cross-sectional external shape elongated on the axis A-A and fitted into the socket part 132 of the implant bore 126 (not shown in FIG. 9) for non-rotational mounting of the abutment 190 to the implant 110. A reentrant annulus 194 surrounds the stem 192 forming at its extremity an annular meeting surface 196 for engaging an abutment seating surface 236 of the implant 110 near the upper gingival surface 122. The reentrant annulus 194 also makes contact with the tapered side surface 138 similar to the flange 176 of the gold cylinder 174 in FIG. 6.

A second part 195 positioned along axis B-B of the angled abutment 190 includes a tapered angulated abutment portion 198. A mounting screw 172 attaches a gold cylinder 174 to the angled abutment 190 and forces flange 176 against prosthetic seating surface 250. An internally-threaded bore 197 in the end of the tapered abutment portion 198 is provided for receiving the mounting screw 172. The wedge-shaped first part 191 terminates at the prosthetic seating surface 250 at the base of the tapered abutment portion 198, at which point the second part 195 begins.

A bore 200 aligned on axis A-A through the first part 191 including the stem 192 receives an abutment mounting bolt 202. The abutment mounting bolt 202 has an externally-threaded shaft 204 for engagement in the implant 110 and a head 206 for locking down the abutment 190 on the implant 110 through the cooperation of two mating shoulders 201 and 205 in the bore 200 and on the head 206, respectively. The head 206 has a hexagonal socket 208 which allows for engagement with a tool when attaching the abutment 190 to the implant 110. The gold cylinder 174 closes the opening into the bore 200 when installed on the tapered abutment portion 198. Thus, when an artificial tooth is fitted to the angled abutment 190, the opening into the bore 200 is not visible.

The angulated abutment 220 shown in FIG. 10 is shorter in the supragingival direction than the abutment 190 of FIG. 9 but connects to the same implant 110. This shorter angulated abutment 220 is similar to abutment 190 in that it has stem 192 and reentrant annulus 194. Abutment 220 also uses a similar abutment mounting bolt 202 with a threaded shaft 204 in a substantially similar bore 200 to affix it to the implant 110. The angulated tapered abutment portion 228, which extends on the second axis B-B, differs in this embodiment in that it meets directly with the supragingival end 226 of the reentrant annulus 194 which has an end substantially in the locus of a plane (not marked) that is perpendicular to the first axis A-A. The wedge-shaped first part 191 in FIG. 9 is eliminated, and the tapered portion 228 starts adjacent the upper gingival surface 122, thereby providing an axially shorter angled-abutment structure in FIG. 10. The gold cylinder or core 174 of FIG. 9 cannot be used with the embodiment of FIG. 10. A different core or tapered cylinder 260 having a wide opening in the locus of a plane parallel to that of the end 226 of the annulus 194 is preferred. The core 260 provides non-rotational engagement between the core 260 and the abutment 220 because it only fits over the abutment 220 in one configuration unlike the abutment 174 of FIG. 9 which can rotate along seating surface 250.

The implant 110 in FIGS. 4-10 is installed in a manner similar to the manner in which implant 10 of FIGS. 1-3 is installed. The mating components and abutments are affixed to the implant 110 after the bridge is removed when gingival healing and osseointegration is complete.

Each of these embodiments and obvious variations thereof is contemplated as falling within the spirit and scope of the invention, which is set forth in the following claims.

WE CLAIM:

1. A single-stage dental implant for use to provide an artificial root at a site in living jawbone covered with gingival tissue having a known thickness over a ridge of said jawbone, said site at a location where a missing tooth emerged from said jawbone, said single-stage implant comprising:

a body sized lengthwise to emerge through said gingival tissue and terminate in a prosthetic seating surface located supragingivally when said implant is anchored in said jawbone, said body including an integral gingival section extending through said gingival tissue, said seating surface being dimensioned to approximate the width dimension of said missing tooth;

means for receiving a component for affixing said implant to a prosthetic dental restoration at said seating surface; and

means at said seating surface for locating said dental restoration on said seating surface.

2. A single-stage dental implant according to claim 1, wherein said prosthetic seating surface is of a generally annular shape and said locating means extends supragingivally from said seating surface to a supragingival extremity of said implant, said locating means having a portion with a diminishing transverse dimension in the direction from said seating surface to said supragingival extremity.

3. A single-stage dental implant according to claim 2, wherein said implant has a generally cylindrical shape and said receiving means comprises an axially-aligned bore extending between an open end at said gingival extremity to a closed end within said body.

4. A single-stage dental implant according to claim 3, wherein said bore includes an internally-threaded part for receiving a prosthesis-attaching screw, a socket part of non-circular cross-section, and an entry part between said socket part and said open end which expands toward said open end.

5. A single-stage dental implant according to claim 1, wherein said gingival section includes a smooth surface for allowing hygienic maintenance of said implant after installation into said jawbone, said body further including an anchoring portion intended to confront said jawbone and having a surface prepared for anchoring in said jawbone.

6. A single-stage dental implant according to claim 5, wherein said anchoring portion has a substantially cylindrical shape the diameter of which is substantially uniform lengthwise and said gingival section expands in width from said anchoring portion to said seating surface.

7. A single-stage dental implant according to claim 5, wherein said anchoring portion includes an externally threaded for screw-engagement in said jawbone.

8. A single-stage dental implant according to claim 7, wherein said receiving means comprises an axially-aligned bore extending from an open end in said gingival extremity to a closed end within said body.

9. A single-stage dental implant according to claim 8, wherein said bore includes an internally-threaded part for receiving a prosthesis-attaching screw, a socket part of non-circular cross-section, and an entry part between said socket part and said open end which expands toward said open end.

10. A single-stage dental implant according to claim 9, wherein said socket part is adapted to receive a tool that screws said implant into said jawbone.

11. A single-stage dental implant according to claim 1, wherein said locating means are encloseable within said dental restoration.

12. In combination, a prosthetic dental means for replacing a missing tooth that emerged from a site in living jawbone;

a single-stage dental implant for use to provide an artificial root at said site in said living jawbone covered with gingival tissue having a known thickness over a ridge of said jawbone, said single-stage implant including a body sized lengthwise to emerge through said gingival tissue and terminate in a prosthetic seating surface located supragingivally when said implant is anchored in said jawbone, said body including an integral gingival section extending through said gingival tissue and means at said seating surface for locating said prosthetic dental means on said seating surface, said seating surface being dimensioned to approximate the width dimension of said missing tooth; and

means for affixing said prosthetic dental means to said implant.

13. The combination according to claim 12, wherein said prosthetic seating surface is of a generally annular shape and said locating means extends supragingivally from said seating surface to a supragingival extremity of said implant, said locating means having a portion with a diminishing transverse dimension in the direction from said seating surface to said supragingival extremity.

14. The combination according to claim 13, wherein said implant has a generally cylindrical shape and said affixing means comprises a screw and an axially-aligned bore extending from an open end in said gingival extremity to a closed end within said body and having an internally-threaded part.

15. The combination according to claim 14, wherein said bore further includes a socket part of non-circular cross-section, and an entry part between said socket part and said open end which expands toward said open end.

16. The combination according to claim 12, wherein said gingival section includes a smooth surface allowing for hygienic maintenance of said implant after installation into said jawbone, said body including an anchoring portion intended to confront said jawbone and having a surface prepared for anchoring in said jawbone.

17. The combination according to claim 16, wherein said anchoring portion has a substantially cylindrical shape the diameter of which is substantially uniform lengthwise and said gingival section expands in width from said anchoring portion to said seating surface.

18. A single-stage dental implant for installation in living jawbone having a ridge that is covered by gingival tissue, said dental implant providing an artificial root on which a dental prosthesis is mounted to replace a missing tooth which formerly emerged from said jawbone, said single-stage dental implant comprising:

an anchoring portion for extending into and integrating with said jawbone;

a gingival section integral with said anchoring portion and extending beyond said ridge of said jawbone;

a seating surface located within said gingival section and above said gingival tissue so as to be exposed after said implant is installed in said jawbone, said seating surface for engaging said dental prostheses; and

means for receiving a component for affixing said dental prosthesis to said implant at said seating surface.

19. A single-stage dental implant according to claim 18, wherein said gingival section includes a tapering part which gradually increases in its transverse dimension in a direction away from said anchoring portion.

20. A single-stage dental implant according to claim 19, wherein a cross-section through any portion of said gingival section perpendicular to the axis of said implant is substantially circular.

21. A single-stage dental implant according to claim 19, wherein said tapering part is adapted to engage said ridge of said jawbone.

22. A single-stage dental implant according to claim 19, wherein said tapering part is dimensioned to substantially replicate a corresponding portion of said missing tooth that extended through said gingival tissue.

23. A single-stage dental implant according to claim 18, further including means for preventing the rotation of said dental prosthesis around said seating surface.

24. A single-stage dental implant according to claim 23, wherein said rotation preventing means is disposed supragingivally beyond said prosthetic seating surface.

25. A single-stage dental implant according to claim 24, wherein said rotation preventing means includes a polygonal boss.

26. A single-stage dental implant according to claim 18, wherein said affixing component is a screw and said receiving means includes a bore having internal threads for threadably engaging said screw.

27. A single-stage dental implant according to claim 26, further including means for accepting a covering component that closes said bore prior to said prosthesis being attached to said seating surface.

28. A single-stage dental implant according to claim 18, wherein said anchoring member includes external threads for engaging said jawbone.

29. A single-stage dental implant according to claim 28, wherein a portion of said external threads is self-tapping.

30. A single-stage dental implant according to claim 18, further including means for locating said prosthesis on said seating surface, said locating means including a surface projecting upwardly from said seating surface for engaging a corresponding surface on said dental prosthesis.

31. A single-stage dental implant according to claim 18, further including a second surface for engaging and supporting said dental prosthesis, said second surface extending in a direction generally transverse to said seating surface.

32. A single-stage dental implant according to claim 31, wherein said second surface is a wall defining an internal bore extending through said gingival section.

33. A single-stage dental implant according to claim 18, wherein said anchoring portion is dimensioned to substantially replicate the corresponding portion of said missing tooth.

34. A single-stage dental implant according to claim 18, wherein said seating surface is defined by the periphery of said gingival section.

35. A single-stage dental implant according to claim 18, wherein said gingival section is nonuniformly dimensioned.

36. A method of providing an artificial root into a living jawbone having a ridge that is covered by gingival tissue, said artificial root for supporting a dental prosthesis, said method comprising the steps of:

producing an opening in said gingival tissue;

producing a bore in said living jawbone adjacent said opening in said gingival tissue;

providing a dental implant having a width approximately the same as the width of said bore, said implant having an anchoring portion for integrating with said jawbone, an integral gingival section for extending above said ridge of said jawbone, and a seating surface located within said gingival section for engaging said dental prostheses;

inserting said implant into said bore; and

maintaining said prosthetic seating surface above said gingival surface.

37. The method of claim 36, further including the step of protecting said exposed seating surface from disturbances caused by chewing.

38. The method of claim 36, wherein said anchoring portion includes external threads and said step of inserting said implant includes the step of rotating said implant into said bore.

39. The method of claim 36, wherein said gingival section includes a tapered portion and said step of maintaining said prosthetic seating surface above said gingival tissue includes the step of engaging said tapered portion of said gingival section on said ridge.

40. The method of claim 36, wherein said gingival section is dimensioned to substantially replicate the corresponding portion of said missing tooth that extended through said gingival tissue.

41. The method of claim 40, wherein said gingival section is nonuniformly dimensioned.

42. A method of anchoring a dental prosthesis in living jawbone having a ridge that is covered by gingival tissue, said method comprising the steps of:

producing an opening in said gingival tissue;

producing a bore into said living jawbone adjacent said opening;

providing a dental implant having a width approximately the same as the width of said bore, said implant having an anchoring portion for integrating with said jawbone, an integral gingival section for extending above said ridge of said jawbone, and a seating surface located within said gingival section for engaging said dental prostheses;

inserting said dental implant into said bore;

maintaining said prosthetic seating surface above said gingival surface after said implant is inserted into said bore to promote the simultaneous healing of said gingival tissue around said gingival section and osseointegration of said dental implant into said jawbone;

positioning said dental prosthesis on said seating surface after said healing of said gingival tissue around said gingival section and said osseointegration of said dental implant into said jawbone; and

affixing said dental prosthesis to said dental implant.

43. The method of claim 42, further including the step of protecting said exposed seating surface from disturbances caused by chewing prior to said steps of positioning and affixing said dental prosthesis to promote said healing of said gingival tissue around said gingival section and said osseointegration of said dental implant into said jawbone.

44. The method of claim 43, wherein said step of protecting said exposed seating surface includes the step of providing a bridge over said exposed seating surface.

45. The method of claim 42, wherein said dental implant includes a bore having internal threads and said step of affixing said dental prosthesis includes the step of threadably engaging said internal threads with a screw having a head portion in contact with said dental prosthesis.

46. The method of claim 45, further including the step of covering the opening of said bore during said healing of said gingival tissue around said gingival section and said osseointegration of said dental implant into said jawbone.

47. The method of claim 45, wherein said dental prosthesis includes an internally-threaded portion that mates with said screw, said step of positioning said dental prosthesis is accomplished in part by the steps of grasping said screw and positioning said screw over said implant.

48. The method of claim 42, wherein said dental prosthesis has an axis that forms an angle with respect to the primary axis of said dental implant.

49. The method of claim 48, wherein said dental prosthesis includes an abutment, a core, and means for fastening said abutment to said core, said core being non-rotationally mounted on said abutment due to corresponding mating surfaces on said core and said abutment.

50. The method of claim 42, wherein said gingival section is dimensioned to substantially replicate the corresponding portion of said missing tooth that extended through said gingival tissue.

51. The method of claim 50, wherein said gingival section is nonuniformly dimensioned.

52. A set of dental components for providing an artificial tooth in living jawbone having a ridge that is covered by gingival tissue, comprising:

a single-stage dental implant providing an artificial root of said artificial tooth, said dental implant including an anchoring portion for integrating with said jawbone, a gingival section integral with said anchoring portion for extending beyond said ridge of said jawbone, and a seating surface located on said gingival section and adapted to protrude beyond said gingival tissue so as to be exposed after said implant is inserted in said jawbone;

a dental prosthesis providing a supragingivally exposed portion of said artificial tooth and being mounted on said seating surface; and

means for affixing said dental prosthesis to said implant at said seating surface;

53. The set of dental components according to claim 52, wherein said affixing means includes a screw for threadably engaging an axially-aligned bore in said dental implant.

54. The set of dental components according to claim 52, wherein said dental prosthesis includes an abutment, an outer core, and means for fastening said abutment to said core.

55. The set of dental components according to claim 54, wherein said abutment engages said seating surface.

56. The set of dental components according to claim 54, wherein said core engages said seating surface.

57. The set of dental components according to claim 54, wherein said fastening means includes a screw.

58. The set of dental components according to claim 54, further including means for prohibiting rotation between said outer core and said abutment after installation.

59. The set of dental components according to claim 58, wherein said rotation-prohibiting means includes mating non-circular surfaces on said outer core and said abutment.

60. The set of dental components according to claim 52, wherein dental prosthesis has an axis that forms an angle with the axis of said implant.

61. The set of dental components according to claim 60, wherein said dental prosthesis includes an abutment, an outer core, and means for fastening said abutment to said core, said abutment engaging said seating surface and said abutment having a second seating surface for engaging said core.

62. The set of dental components according to claim 61, wherein said second seating surface is in a plane that is generally perpendicular to said axis of said implant.

63. The set of dental components according to claim 61, wherein said second seating surface provides for non-rotational engagement of said outer core on said abutment.

64. The set of dental components according to claim 61, wherein said second seating surface is in a plane that is generally perpendicular to said axis of said dental prosthesis.

65. The set of dental components according to claim 52, wherein said affixing means is adapted to be temporarily coupled to said dental prosthesis such that said affixing means and said dental prosthesis can be delivered to said implant simultaneously.

66. In combination, a single-stage dental implant providing an artificial root at a site in said living jawbone covered with gingival tissue having a known thickness over a ridge of said jawbone, said single-stage implant including an anchoring section for integrating with said jawbone and a gingival section integral with and positioned above said anchoring portion, said gingival section extending through said gingival tissue and having a prosthetic seating surface located supragingivally after said implant is installed in said jawbone;

a dental prosthesis mounted on said prosthetic seating surface, said dental prosthesis having an axis that is at an angle with the axis of said dental implant; and

means for affixing said dental prosthesis to said implant.

67. The combination according to claim 66, wherein said dental prosthesis includes an abutment, an outer core, and means for fastening said abutment to said core.

68. The combination according to claim 67, wherein said abutment engages said seating surface.

69. The combination according to claim 67, wherein said core engages said seating surface.

70. The combination according to claim 67, wherein said fastening means includes a screw.

71. The combination according to claim 67, further including means for prohibiting rotation between said outer core and said abutment after installation.

72. The combination according to claims 67, wherein said rotation-prohibiting means includes mating non-circular surfaces on said outer core and said abutment.

73. The combination according to claim 67, wherein said abutment includes a second seating surface for engaging said core.

74. The combination according to claim 73, wherein said second seating surface is in a plane that is generally perpendicular to said axis of said implant.

75. The combination according to claim 73, wherein said second seating surface provides for non-rotational engagement of said outer core on said abutment.

76. The combination according to claim 73, wherein said second seating surface is in a plane that is generally perpendicular to said axis of said dental prosthesis.

77. The combination according to claim 67, wherein said abutment has a reentrant annulus engaging said dental implant, said reentrant annulus being flush with the outer surface of said gingival section.

78. The combination according to claim 77, wherein an inside portion of said reentrant annulus engages a surface on said gingival section to locate said abutment on said implant.

79. The combination according to claim 77, wherein a portion of said reentrant annulus is immediately adjacent a second seating surface for engaging said core.

80. The combination according to claim 77, wherein said reentrant annulus surrounds a polygonal stem of said abutment, said stem engaging a corresponding polygonal bore in said implant for providing nonrotational engagement of said abutment on said implant.

81. The combination according to claim 66, further including means for preventing the rotation of said dental prosthesis around said seating surface.

82. The combination according to claim 81, wherein said rotation preventing means is positioned below said seating surface.

83. The combination according to claim 66, wherein said affixing means includes a screw threadably engaging an axially-aligned bore in said dental implant.

84. The combination according to claim 83, wherein said bore includes a socket portion of non-circular cross-section and said dental prosthesis includes a corresponding portion to fit with in said socket portion to prevent rotation of said dental prosthesis around said implant.

85. The combination according to claim 66, further including means for locating said dental prosthesis on said seating surface, said locating means including a surface projecting upwardly from said seating surface for engaging a corresponding surface on said dental prosthesis.

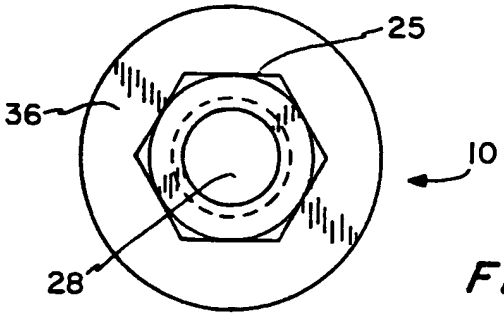

FIG. 2

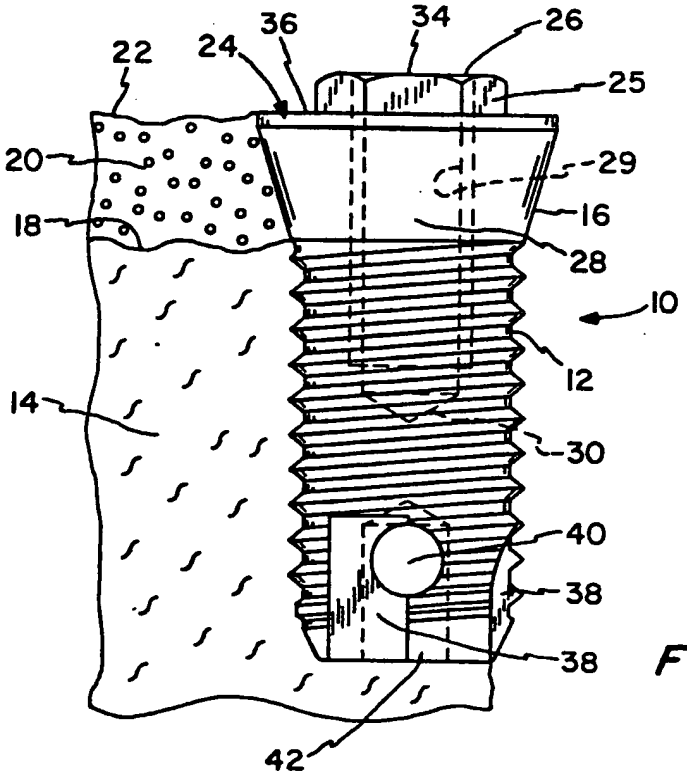

FIG. 1

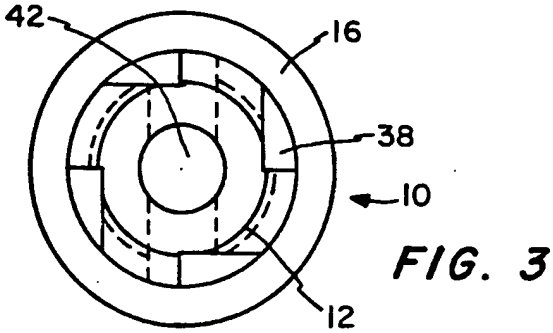

FIG. 3

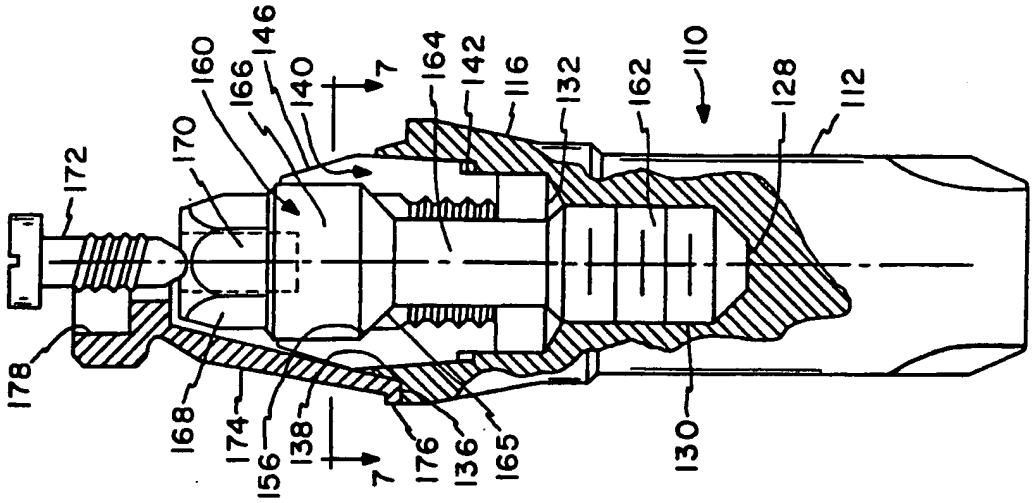

FIG. 6

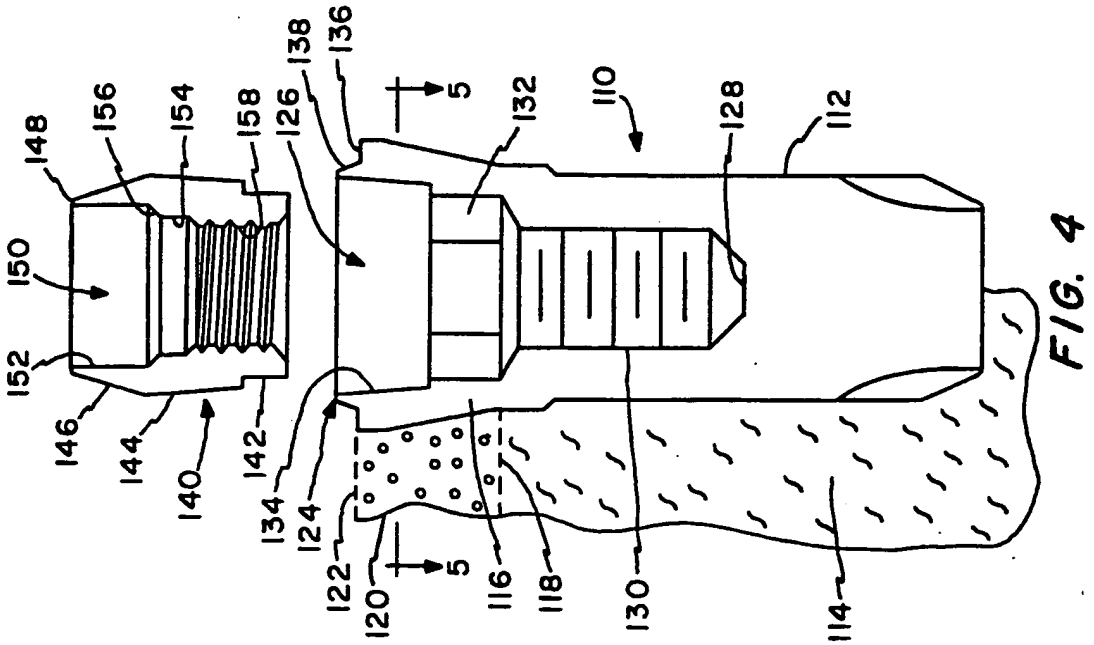

FIG. 4

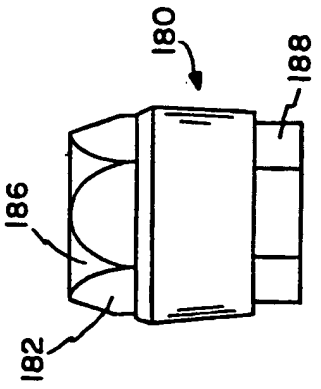

FIG. 8

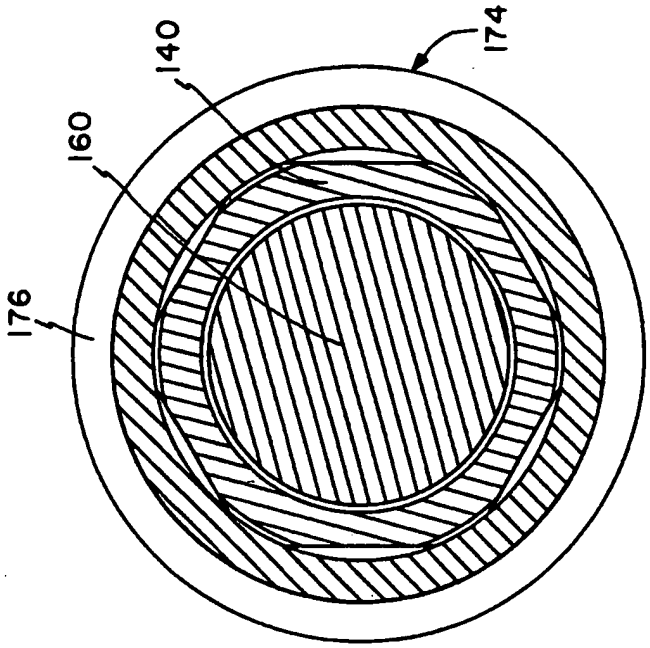

FIG. 7

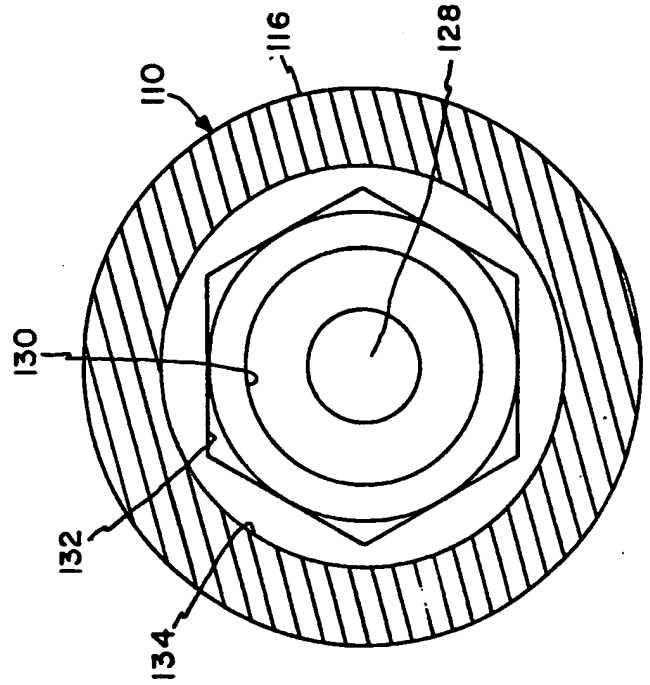

FIG. 5

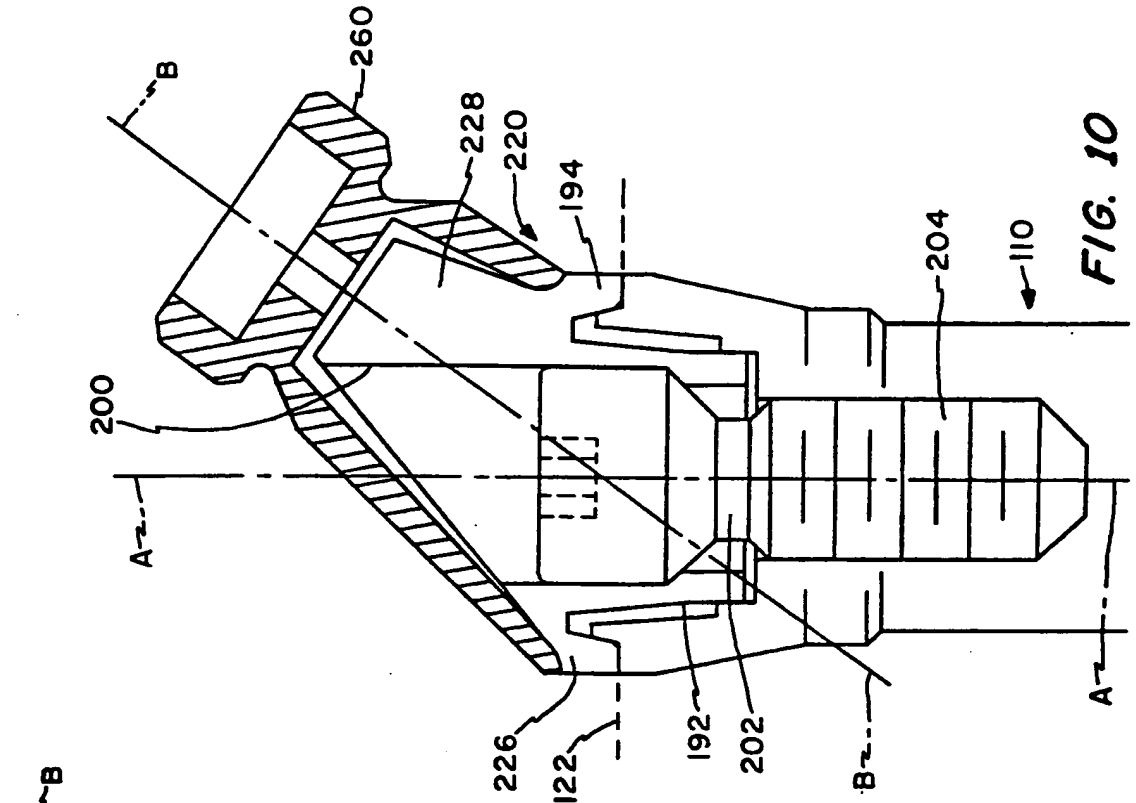
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FIG. 10

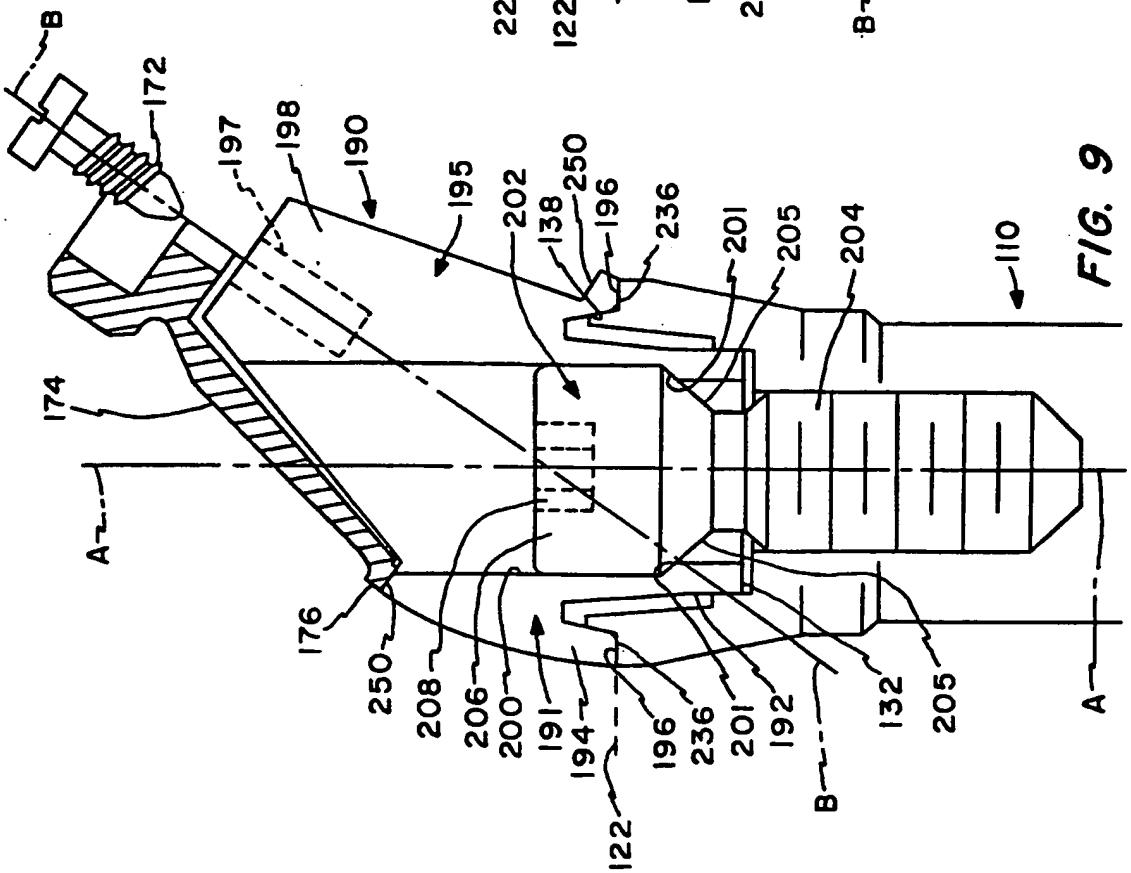
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FIG. 9

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/10792

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) :A61C 8/00
US CL :433/173
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 433/172-176

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X --- Y	US, A, 4,826,434 (KRUEGER) 02 May 1989, see Figs. 1, 3 and 6.	1, 12, 18-22, 26-29, 33-36, 38, 39, 42, 45, 51-53, 65 --- 6, 17, 37, 40, 41, 43, 46, 48, 50

[X] Further documents are listed in the continuation of Box C. [ ] See patent family annex.

*	Special categories of cited documents:	"T"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search 02 OCTOBER 1996	Date of mailing of the international search report 16OCT 1996
Name and mailing address of the ISA/US Commissioner of Patents and Trademarks Box PCT Washington, D.C. 20231 Facsimile No. (703) 305-3590	Authorized officer Marcia Sinnett for CARY O'CONNOR Telephone No. (703) 308-2701

Form PCT/ISA/210 (second sheet)(July 1992)*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US96/10792

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X –, P Y	US, A, 5,433,606 (NIZNICK ET AL.) 18 July 1995, see column 5 line 47 to column 7 line 45.	1-3, 5, 7, 8, 11-14, 16, 18, 23-31, 33, 34, 52, 53, 65 ——— 4, 6, 9, 10, 15, 17, 54, 55, 57, 58, 61, 67, 68, 70, 71, 73, 77-79
Y	US, A, 5,316,477 (CALDERON) 31 May 1994, see Figs. 10A, and 11A.	48, 60, 66, 81-85
Y	GB, A, 2,252,501 (EVANS ET AL.) 12 August 1992, see Fig. 2 ,and page 3 lines 5-22.	4, 9, 10, 15, 82, 84
Y	US, A, 5,000,685 (BRAJNOVIC) 19 March 1991, see column 3 lines 17-51.	49, 54, 55, 57, 58, 61, 67, 68, 70, 71, 73, 77-79
Y	US, A, 5,030,096 (HURSON ET AL.) 09 July 1991, see column 3 lines 8-45.	37, 43, 46
Y	US, A, 5,297,963 (DAFATRY) 29 March 1994, see column 2 lines 28-33.	40, 41, 50